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FACULTY OF ENGINEERING

DEPARTMENT OF AGRICULTURAL MECHANISATION AND IRRIGATION ENGINEERING

DESIGN AND CONSTRUCTION OF A SHEA NUT OIL SCREW PRESS EXPELLER

BY

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ABSTRACT

Vegetable oils and fats have gained popularity in food, cosmetic, soap, pharmaceutical and medical industries for the production of cooking oil and margarine, pomade, toilet soaps, drugs and medical ointments respectively. Recently, they have found their uses in energy and automotive industries as biodiesel and engineering industry as cooling fluid in machining process and lubricants for machine components.

The objectives of this work are: to design a small scale screw press oil expeller for shea nut oil extraction; to fabricate the components of the expeller based on the design specifications and to test the expeller after fabrication and assembly of the components.

While in designing and in material selection, consideration will be given to the techno-economic status of the micro and small scale shea oil processors who are the intended users of the machine.

The functional parts of the machine included barrel, worm shaft, prime mover, oil outlet, cake outlet, hopper, pulley, stove, transmission belts and bearings. The worm shaft is at an increasing diameter while the screw system is at a decreasing pitch, a combination that is essential for obtaining maximum pressure for oil extraction and cake extrusion process.

In operation, the gradually built-up pressure along the worm shaft travel conveys, crushes, grinds, presses and squeezes oil out of the seeds into the oil outlet via the oil channel. The residual cake from where the oil is extracted is extruded out of the cake outlet in form of flakes. Heat from the stove helps break the latex content of shea kernels for easy squeezing and flow of oil.

Powered by a 4hp motor, the expeller has an extraction efficiency, oil yield and extraction loss of 8.439%, 3.785% and 12.978% respectively. The expeller can be used by small scale shea oil extraction in rural and urban communities.

A cottage shea nut oil processing plant based on this technology can provide employment for at least two persons at the same time providing shea oil/butter at affordable costs for rural dwellers.

The expeller has an initial cost of UGX 384,500 which includes the cost of material, machinery and hired labor to construct the material. With a monthly depreciation of UGX 32041.67, interest of UGX 8010.42, total operating cost of 38450 per month and monthly expected revenue of UGX 308581 from sale of shea oil/butter, the investment in the expeller has a payback period of 1.46 month. The investment seems viable since it has a benefit/cost ratio of 6.78.

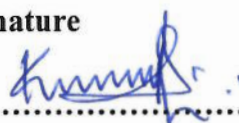
DISCLAIMER STATEMENT

I, **KIDEGA RICHARD** do hereby declare that this final year project report is the original copy of my personal research carried out on the design, construction and testing of a screw press expeller for shea nut oil extraction under the supervision of personnel below. No parts of it are duplicated unless cited and it has never been submitted in for award of bachelor's degree of Agricultural Mechanization and Irrigation Engineering of Busitema University or any other institution of learning.

Author

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Signature


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Date

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APPROVAL

This project report was compiled and submitted to the department of Agricultural Mechanization and Irrigation Engineering under the following supervision;

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May the Almighty God continuously bless you and reward abundantly.

DEDICATION

I dedicate this final year report to my parents, Mr. Oyet Paul and Mrs. Adong Concy and my uncle Mr. Ocira Alex, who committed their valuable time and finances to my studies up this far.

Special dedication goes to the family of Mr. Amone Vincent Kagwa and Mrs. Amony Filda, for without you I wouldn't be where I am.

I also dedicate this report to my girlfriend Atto Florence, for you have always been there for me in times of hardship.

May the Almighty God bless you abundantly.

LIST OF SYMBOLS

Cal	Calorie
G	Grams
hP	Horse power
J	Joules
K	Kelvin
Kg	Kilogram
kW	Kilowatts
L	Length
M	Mass
M	Moisture content
Mm	Millimeter
N	Newton
Pa	Pascal
Rpm	Revolution per minute
S	Second
T	Time
ρ	Density

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CHAPTER ONE

1.1 BACKGROUND

In Sub-Saharan Africa, many indigenous fruit trees although undomesticated play an important role in sustaining the livelihoods of people living in rural areas (Maghembe et al., 1994). These trees are important traditional sources of fruits, beverages, nuts and edible oil. The nutritional value of indigenous fruit bearing tree species indicates that many are rich in sugars, essential vitamins and minerals while some of their seeds are high in edible oil and proteins. The seeds have the potential of serving as the main source of edible vegetable oil for many rural people and in the economy of many countries (Ullah et al., 2003).

The shea tree (*Vitellaria paradoxa/ nilotica*) is one of such indigenous wild fruit trees with enormous nutritional benefits. This fruit tree is found in the parkland belts stretching from Senegal through Sudanian region, to Western part of Ethiopia (White, 1983). The eastern sub species *nilotica* occurs in Ethiopia, southern Sudan and north-eastern Uganda (Katende et al., 1995). The fruit pulp and oil from the shea nuts have been reported to be vital for supporting the livelihoods of the parklands communities (Okullo et al., 2004).

Local inhabitants of shea growing areas say that no one owns the shea tree, since it germinates and grows on its own. The shea tree becomes fire-resistant after it passes the germination stage of a period of three to five years. Once it survives the first five years of its early stages of germination and growth, it grows slowly and takes about fifteen years to reach maturity and can live for up to about three hundred years bearing fruit for over two hundred years (Dogbevi, 2009)

The fruit is edible with a nutritious sweet and spice able flavor pulp. The fruit pulp is also a source of food for other animals such as elephants, sheep, pigs, bats and birds (USAID, 2004). Apart from the fruit playing an important role in the diets it is also sold in local markets (FAO, 2007). In Uganda the shea tree is a dominant indigenous tree species in the savannah wood lands of north, north eastern and West Nile sub regions of Uganda (Okullo, et al., 2004). Due to its multiple uses, the tree has been described as a "Green Gift from God to man Kind" (Guru, 2007).

The fruits and nuts or seeds obtained from the shea tree are of nutritional and economic significance to the communities around the parklands (Prokarite, 2007). Shea oil extracted

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